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TITLE: ROTATING DEVICE PROVIDED WITH RADIAL  
DYNAMIC PRESSURE BEARING PART, AND RECORDING DEVICE

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ABSTRACT:

PROBLEM TO BE SOLVED: To improve rotating accuracy by making the rotational center of a rotating part eccentric in a fixed direction to effectively prevent NRRO (asynchronous shaking) and RRO (synchronous shaking), and to suppress the increase of manufacturing difficulty or electromagnetic vibration.

SOLUTION: An air flow guiding plate 32 is provided close to the upper and lower surfaces of a hard disk 12 fitted around a hub 24. The rear side surface of the air flow guiding plate 32 in the rotational

direction of the hard disk  
12 is set as a guiding surface 32a bent to form a projected arc shape forward  
in the rotational direction. The guiding surface 32a is directed inward in a diameter direction while it is moved forward in the rotational direction from the circular arc inner peripheral wall part 10b of a casing 10, and brought close to the specified position of a peripheral direction in the outer peripheral close space of each outer peripheral surface part of the flange part of the hub 24, a spacer 8 and a clamper 30.

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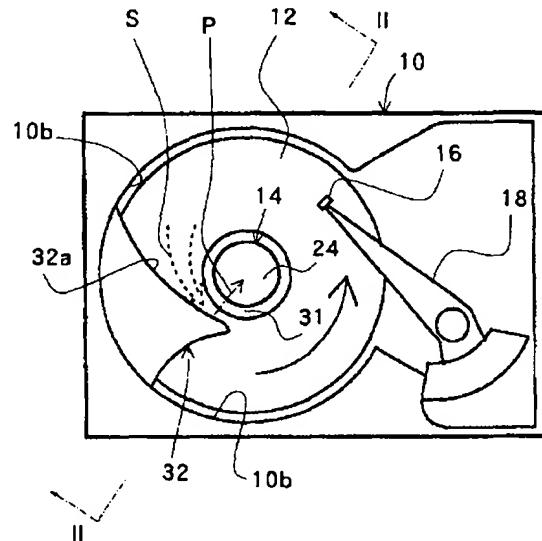
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(54)【発明の名称】 ラジアル動圧軸受部を備えた回転装置及び記録装置

(57)【要約】

【課題】 回転部の回転中心を一定の向きに偏心させることによりNRRD及びRROを効果的に防いで回転精度を高めることができ、而も製造の困難性や電磁振動の助長を招くことがない。

【解決手段】 ハブ24に外嵌固定されたハードディスク12の上下面に近接した気流案内板32を設ける。ハードディスク12の回転方向における気流案内板32の後方側の面を、回転方向における前方に凸の弧状をなすように湾曲した案内面32aとする。案内面32aは、ケーシング10の円弧状内周壁部10bから、回転方向における前方に進むに従い径方向内方に向かいつつ、ハブ24の鋸状部24a、スペーサ18及びクランバ30の各外周面部の外周近傍空間のうち周方向の所定位置に近寄る。



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## 【特許請求の範囲】

【請求項1】少なくともラジアル動圧軸受部を介して固定部に対し回転部が一定軸線の回りに回転自在に支持され、その回転部は、所定の外周面部を有する回転基部と、その回転基部における前記所定の外周面部から流体が存在する空間内に径方向外方に回転基部と同軸状に張出した1又は2以上の平板状部とを備えるものである回転装置であって、前記固定部に固定的に支持された流体案内部が、前記平板状部の全て又は一部のそれそれにおける軸線方向一方側の面又は両側の面に近接した状態で設けられ、前記流体案内部は、前記空間において平板状部の回転に伴い移動する流体を、その流体案内部の径方向内方の、回転基部における前記所定外周面部の外周近傍空間のうち周方向の所定位置に集まるよう案内し、そのように案内された流体の流れにより、回転基部に対し前記所定位置付近において所定の向きに圧力を加えるものであり、回転部の回転時に、前記所定の向きの圧力によって、回転部の回転中心が一定の向きに偏心し且つその状態が維持されることを特徴とする回転装置。

【請求項2】流体案内部が、回転基部の所定外周面部よりも径方向外方の一定位置から、回転部の回転方向における前方に進むに従い径方向内方に向かいつつ所定位置に近寄る案内面を有し、その案内面により、平板状部の回転に伴い移動する流体を、その案内面の径方向内方の、回転基部における前記所定外周面部の外周近傍空間のうち周方向の所定位置に集まるよう案内するものである請求項1記載の回転装置。

【請求項3】流体案内部により案内される流体の流れによる圧力が回転基部に対し加わらなくても通常とり得る姿勢において回転部の回転中心が一定の向きに偏心する場合に、その向きと流体案内部により案内された流体の流れにより回転基部に対し加わる圧力の向きとが一致しない請求項1又は2記載の回転装置。

【請求項4】請求項1、2又は3記載のラジアル動圧軸受部を備えた回転装置を備えており、その回転装置における平板状部が記録媒体である記録装置。

【請求項5】記録媒体に対する読み書きヘッドを有し、その読み書きヘッドの位置が、記録媒体の回転時に流体案内部により案内される流体により読み書き作業に実質的な影響を及ぼさない位置である請求項4記載の記録装置。

【請求項6】流体案内部により流体が案内される周方向の所定位置と読み書きヘッドの位置が、回転部を挟んで逆側である請求項5記載の記録装置。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は、記録ディスク等の回転に伴い移動する流体を利用して振れ回り等を防ぐことにより回転精度を高めることができる、ラジアル動圧軸受部を備えた回転装置及び記録装置に関する。

## 【0002】

【従来の技術及び発明が解決しようとする課題】近年、パソコン用のプログラムやデータ量は増大し、ハードディスク駆動装置等の記録ディスク回転型の記録装置の回転精度についての要請は益々厳しくなりつつある。このような記録装置におけるスピンドルモータにラジアル動圧軸受等非接触で軸支持する軸受が用いられている場合、そのラジアル動圧軸受にハーフホーラル(half speed whirl)等によるNRRO(非同期振れ)やRRO(同期振れ)が発生して回転精度向上を阻害する因となっていた。

【0003】ラジアル動圧軸受における振れ回りを防ぐためには、ラジアル動圧軸受を構成するスリーブ部材又は軸部材の断面形状として真円ではない適切な異形断面を採用するという手段が提案されているが、そのような断面の部材の加工には困難を伴う。また特開平11-5918号公報には、ラジアル動圧軸受を備えたスピンドルモータのステータに局所的な磁気アンバランスを形成することにより、そのラジアル動圧軸受における回転中心を微小寸法偏心させて軸の振れ回りを防ぐ技術が開示されている。しかしながら、ステータについてのこのような加工は容易ではなく、而もステータにおける局所的な磁気アンバランスは、回転時に電磁振動を助長するおそれがある。

【0004】更に、記録ディスク回転型の記録装置以外のラジアル動圧軸受を備えた回転装置についても、振れ回り等によるNRROやRROを防いで回転精度を高める要請は同様に存在する。

【0005】本発明は、従来技術に存した上記のような課題に鑑み行われたものであって、その目的とするところは、回転部の回転中心を一定の向きに偏心させることによりNRRO及びRROを効果的に防いで回転精度を高めることができ、而も製造の困難性や電磁振動の助長を招くことがないラジアル動圧軸受部を備えた回転装置及び記録装置を提供することにある。

## 【0006】

【課題を解決するための手段】(1) 本発明の回転装置は、少なくともラジアル動圧軸受部を介して固定部に対し回転部が一定軸線の回りに回転自在に支持され、その回転部は、所定の外周面部を有する回転基部と、その回転基部における前記所定の外周面部から流体が存在する空間内に径方向外方に回転基部と同軸状に張出した1又は2以上の平板状部とを備えるものである回転装置であって、前記固定部に固定的に支持された流体案内部が、前記平板状部の全て又は一部のそれそれにおける軸線方向一方側の面又は両側の面に近接した状態で設けられ、前記流体案内部は、前記空間において平板状部の回転に伴い移動する流体を、その流体案内部の径方向内方の、回転基部における前記所定外周面部の外周近傍空間のうち周方向の所定位置に集まるよう案内し、そのように案

内された流体の流れにより、回転基部に対し前記所定位置付近において所定の向きに圧力を加えるものであり、回転部の回転時に、前記所定の向きの圧力によって、回転部の回転中心が一定の向きに偏心し且つその状態が維持されることを特徴とする（請求項1）。

【0007】回転部の回転により平板状部が回転基部と共に同軸状に回転する。平板状部は、回転基部における所定の外周面部から流体が存在する空間内に径方向外方に張出しているので、その平板状部の軸線方向の何れかの側の面に臨む流体は、平板状部の回転に伴い移動する。このように移動する流体は、平板状部の軸線方向の何れかの側の面に近接した状態で設けられた流体案内部によって、回転基部の所定外周面部（その流体案内部の径方向内方の所定外周面部）の外周近傍空間のうち周方向における所定位置に集まるよう案内される。そのように案内された流体の流れにより、回転基部に対し前記所定位置付近において所定の向きに圧力が加えられる。

【0008】このように、回転部の回転時には、前記所定の向きの圧力が回転基部に対し継続的に加わるので、それによって、ラジアル動圧軸受部における周方向の一定位置（前記所定の向きに対応する位置）の軸受隙間が他の部分の軸受隙間よりも小さい状態が維持される。すなわち、回転部の回転中心が一定の向きに偏心し且つその状態が維持される。これにより、ラジアル動圧軸受部に側圧が付与された状態となり、軸受剛性が高まるのでハーフホワール（half speed whirl）等の振れ回りを始めとする回転部のNRRO（非同期振れ）及びRRO（同期振れ）が効果的に防がれ、回転精度を高めることができる。

【0009】固定部に対し回転部を回転自在に支持するためのラジアル動圧軸受部は、軸固定型であっても軸回転型であってもよい。何れにせよ、ラジアル動圧軸受部においては、通常、軸部とスリープ部との軸受隙間に充填された潤滑油などの潤滑液又は潤滑気体等の潤滑流体を介して回転部が固定部に対し径方向に支持される。このような回転部の回転支持は、スラスト動圧軸受部等と適宜組合せて行うものとすることができる。なお、この回転装置は、固定部（又はその一部）と回転部の一部（通常、回転基部）により電動機を構成するものとすることができる。その場合、固定部にステータ、回転部にロータが設けられる。

【0010】固定部は、平板状部に対し軸心方向の両側又は一方の側（2以上の平板状部を有する場合、全平板状部に対する軸心方向の両側又は一方の側）の全部又は一部に相対する内面部を有するものとすることができる。また固定部は、平板状部の外周側を全て又は部分的に囲繞する内周壁部を有するものとすることができる。これらの内面部及び内周壁部は、少なくとも流体案内部が位置する部分を含むものとすることができる。

【0011】平板状部は、例えば、回転基部に外嵌され

て固定的に保持された円環状板体（例えばハードディスク等の各種磁気ディスクや各種光ディスク等のディスク形記録媒体）とすることができます。このような円環状板体が2枚以上外嵌保持される場合は、例えば、円環状板体同士の間の内周部に環状スペーサを介して軸線方向間隔おきに同軸状に保持するものとすることができる。平板状部の軸線方向両側の面の法線は、通常、その平板状部及び回転基部の軸線方向となる。なお、平板状部は回転基部に対し着脱可能とすることもできるが、回転中の振動発生等の不都合を防ぐ上で、固定保持がより望ましい。

【0012】回転基部は、例えばカップ形のハブとすることができる。回転基部における所定の外周面部は、一般には、円筒面形状である。前記のように2枚以上の円環状板体同士の間の内周部に環状スペーザを配する場合は、その環状スペーザが回転基部の一部を構成し、その外周面部が前記の所定の外周面部を構成するものとすることができる。

【0013】平板状部が所定の外周面部から張出した空間内に存在する流体は、通常の場合、気体、特に空気である。前記空間は、密閉空間又は開放空間の何れでもよいが、その空間内の流体は、回転部が静止状態である場合に、通常の場合実質上静止状態となるものとすることが好ましい。

【0014】流体案内部は、平板状部の全て又は一部のそれぞれにおける軸線方向一方の側の面又は両方の側の面（通常の場合、法線が軸線方向である面）それぞれに近接した状態で設けられる。すなわち、回転基部から張出した平板状部が1つである場合においてその平板状部の一方又は両方の面、或いは、2以上の平板状部が保持されている場合において一部又は全ての平板状部のそれぞれにおける一方の面又は両方の面に近接した状態で設けることができる。

【0015】1つの平板状部の両方の面における流体流のバランスを欠いて振動等の不都合が生じることを防ぐ上では、平板状部の軸線方向の両側の面にそれぞれ臨む流体案内部が設けられることが好ましく、その流体案内部は、平板状部の軸線方向の両側の面において案内する流体の流れが実質上等しくなるようにすること（例えば両面側において流体案内部を実質上同一とすること）が好ましい。また、2以上の流体案内部を設ける場合、回転部の回転時における回転中心の偏心が軸線方向においてアンバランスにならないように設けることが望ましい。そのためには、例えば軸線方向において対称的に流体案内部を設けたり、回転基部の軸線方向における一定位置に加わる圧力が他よりも大きくなるように流体案内部を設けることもできる。

【0016】流体案内部は、軸線方向に相対する面同士の間においてその両面に近接した位置（その一方の面が固定部の面である場合は、その面に近接した位置又はそ

の面と接触した状態若しくは一体となった状態)であることが好ましい。このような軸線方向に相対する両面は、軸線方向に隣接する平板状部の軸線方向の何れかの側の面同士である場合(この場合、流体案内部は、径向外方において固定部に支持されるものとすることができる)と、一方が平板状部の軸線方向の何れかの側の面であり、他方が、その面と軸線方向に相対する固定部の面である場合(この場合、流体案内部は、径向外方において固定部に支持されるか、軸線方向他方における固定部に支持されるものとすることができる)がある。

【0017】流体案内部は、例えば、回転基部の所定外周面部よりも径向外方の一定位置から、回転部の回転方向における前方に進むに従い径方向内方に向かい一つ所定位置に近寄る案内面を有し、その案内面により、平板状部の回転に伴い移動する流体を、その案内面の径方向内方の、回転基部における前記所定外周面部の外周近傍空間のうち周方向の所定位置に集まるよう案内するものとすることができる(請求項2)。

【0018】前記案内面は、回転軸線に平行な面とすることが一般的であるが、回転軸線に対し傾斜させることもできる。

【0019】また、案内面は、例えば回転部の回転方向における前方に凸の弧状をなす湾曲面とすることができるほか、平面とすることもできる。

【0020】なお、案内面は、平板状部の外周縁部付近又はそれよりも径向外方の一定位置から、回転部の回転方向における前方に進むに従い径方向内方に向かい一つ所定位置に近寄るものとすることが好ましい。

【0021】(2) 上記のラジアル動圧軸受部を備えた回転装置は、流体案内部により案内される流体の流れによる圧力が回転基部に対し加わらなくても通常とり得る姿勢において回転部の回転中心が一定の向きに偏心する場合に、その向きと流体案内部により案内された流体の流れにより回転基部に対し加わる圧力の向きとが一致しないものとすることが望ましい(請求項3)。

【0022】例えば、通常とり得る姿勢において、回転軸線がほぼ水平である場合のように回転軸線が重力の方向に一致しない場合、流体案内部により案内される流体の流れによる圧力が回転基部に対し加わらなくても、回転部の回転中心は重力によって一定の向きに偏心し得る。このような場合、その偏心の向きと流体案内部により案内された流体の流れにより回転基部に対し加わる圧力の向きとが一致すると、回転部の回転中心の偏心が過大になり、ラジアル動圧軸受部の損傷等の不都合を招くおそれがある。特に、縦置きと横置きが可能な回転装置のように、通常とり得る姿勢が複数存在する場合に、ある姿勢では重力等による偏心がないか又は重力等による偏心の向きと流体案内部により案内された流体の流れにより回転基部に対し加わる圧力の向きが一致しないが、別の姿勢において両者が一致することがある。

【0023】このような場合に、回転装置が通常とり得る姿勢において両者の向きが一致しないようにすることにより、ラジアル動圧軸受部の損傷等の不都合を招くことを防ぐことができる。両者の向きは、例えば45°乃至135°中心角程度異なるものとすることができ、90度中心角程度異なることが好ましい。

【0024】(3) 本発明の記録装置は、上記ラジアル動圧軸受部を備えた回転装置を備えており、その回転装置における平板状部が記録媒体であるものとすることができる(請求項4)。

【0025】この場合、記録媒体の回転時に流体案内部により案内される流体により、ラジアル動圧軸受部における振れ回りを始めとする回転部のNRRO及びRRROを効果的に防いで回転精度を高め、以って記録媒体に対する読み書き精度を高めることができる。

【0026】なお、この回転装置は、固定部(又はその一部)と回転部の一部(通常、回転基部)により電動機を構成するものとすることが好ましい。

【0027】この記録装置は、記録媒体に対する読み書きヘッドを有し、その読み書きヘッドの位置(周方向の一定位置とすることができる)が、記録媒体の回転時に流体案内部により案内される流体により読み書き作業に実質的な影響を及ぼさない位置であることが望ましい(請求項5)。

【0028】この場合、記録媒体の回転時に流体案内部により案内される流体により回転精度を高めると共に、その流体により読み書きヘッドの読み書き作業に悪影響が生ずることが防がれる。特に、記録媒体面上に浮上する浮動ヘッドラライダを備えた読み書きヘッドにおいて有用である。なお、読み書きヘッドは、読み取り専用又は書き込み専用であってもよい。

【0029】そのためには、例えば流体案内部により流体が案内される周方向の所定位置と読み書きヘッドの位置が、回転部を挟んで逆側であるものとすることができる(請求項6)。

【0030】

【発明の実施の形態】本発明の実施の形態を、図面を参照しつつ説明する。

【0031】図1乃至図3は、本発明の記録装置(すなわちラジアル動圧軸受部を備えた回転装置)の実施の形態の一例としてのハードディスク駆動装置に関するものであって、図1は、天板を取り外した状態のハードディスク駆動装置の平面図、図2は、図1におけるII-II線拡大断面図、図3は、ハードディスクを駆動するスピンドルモータにおけるラジアル動圧軸受部の拡大横断面図である。

【0032】このハードディスク駆動装置は、外形が直方体形状である上方開口の箱状のケーシング10内に、主として、ハードディスク12を固定保持したスピンドルモータ14(電動機)と、浮動ヘッドラライダ(図示

せず)を備えた読み書き用の磁気ヘッド16を先端部に支持したアクセスアーム18が設けられ、天板20により密閉されてなる。ケーシング10内には空気が存在する。

【0033】スピンドルモータ14は、下端がケーシング10の底板10aに固定された固定軸体22に対しカップ形のハブ24の内部に設けられた回転スリーブ部26が潤滑油27を介し外嵌されることにより構成されるラジアル動圧軸受部28及びその上方のスラスト動圧軸受部29によって、回転スリーブ部26が固定軸体22に非接触な状態で回転自在に支持されてなる。

【0034】スピンドルモータ14のハブ24には、4枚(3枚以下又は5枚以上でもよい)のハードディスク12がそのハブ24と同軸状に外嵌されて固定保持されている。下端のハードディスク12はハブ24の下端の鍔状部24a上に支持され、その上に環状のスペーサ30とハードディスク12が交互に積層され、最上部のハードディスク12上に環状のクランバ31が固定されることにより、各ハードディスク12は軸線方向間隔おきに固定保持されている。また、全ハードディスク12の外周側は、アクセスアーム18が存在する側を除いて、ケーシング10におけるスピンドルモータ14と同心状の円弧状内周壁部10bに囲繞されている。

【0035】上記において、主にケーシング10と固定軸体22が固定部を構成し、主に回転スリーブ部26とハブ24とスペーサ30とクランバ31及びハードディスク12が回転部を構成し、そのうち回転スリーブ部26とハブ24とスペーサ30とクランバ31は回転基部を構成する。

【0036】気流案内板32(流体案内部)は、アクセスアーム18に支持された磁気ヘッド16に対しハブ24を挟んでほぼ逆側の周方向位置から、ハードディスク12の回転方向(図1における矢印の向き、すなわち左回り)における後方側の一定範囲にわたり設けられている。気流案内板32は、各ハードディスク12の上下面に近接した状態で、径方向外方部がケーシング10の円弧状内周壁部10bに支持されている。下端のハードディスク12の下面側の気流案内板32は、上面が下端のハードディスク12の下面に、下面がケーシング10内の底面に近接し、ハードディスク12同士の間の気流案内板32は、上下面がそれぞれ上側のハードディスク12の下面及び下側のハードディスク12の上面に近接し、上端のハードディスク12の上面側の気流案内板32は、下面が上端のハードディスク12の上面に、上面が天板20の下面に近接する。全ての気流案内板32の平面形状及び平面視における位置は一致している(尤も、必ずしも一致することを要するものではない。)。

【0037】ハードディスク12の回転方向における気流案内板32の後方側の面が、回転方向における前方に凸の弧状をなすように湾曲した案内面32a(回転軸線

に平行な面、すなわち回転軸線に直交する面に対し垂直な面)を構成している。この案内面32aは、ケーシング10の円弧状内周壁部10bから、回転方向における前方に進むに従い径方向内方に向かいつつ、ハブ24の鍔状部24a、スペーサ30及びクランバ31の各外周面部(回転基部の所定外周面部)の外周近傍空間のうち周方向の所定位置(磁気ヘッド16に対しハブ24を挟んでほぼ逆側の位置)に近寄る。

【0038】スピンドルモータ14の回転によりハードディスク12が回転すると、各ハードディスク12の上下面にそれぞれ臨む空気は、ハードディスク12の回転に伴い移動する。このように移動する空気は、各ハードディスク12の上下面に近接した状態で設けられた各気流案内板32の案内面32aによって図1における矢示Sのように案内されて鍔状部24a、スペーサ30及びクランバ31の各外周面部の外周近傍空間のうち所定位置に集まる。このように案内される空気の流れにより、鍔状部24a、スペーサ30及びクランバ31を介してハブ24及び回転スリーブ部26に対し前記所定位置付近において図1及び図3における矢示Pの向きに圧力が加わる。スピンドルモータ14の回転中は矢示Pの向きの圧力がハブ24及び回転スリーブ部26に対し継続的に加わるので、それによって、図3に示すようにラジアル動圧軸受部における周方向の一定位置の軸受隙間が他の部分の軸受隙間よりも小さい状態が維持される。すなわち、回転スリーブ部26の回転中心が一定の向きに偏心し且つその状態が維持される。これにより、ラジアル動圧軸受部におけるハーフホワール等によるNRRO及びRRDが効果的に防がれ、回転精度を高めることができ、以て、各ハードディスク12に対する読み書きヘッドによる読み書きの精度を高めることができる。

【0039】また、気流案内板32の案内面32aによってハブ24等に対し空気流による圧力を加える位置と読み書きヘッドの位置がハブ24を挟んで逆側なので、空気流により読み書きヘッドの読み書き作業に悪影響が生ずることが防がれる。

【0040】更に、全てのハードディスク12の上下面に近接した状態で気流案内板32が設けられ、全ての気流案内板32の平面形状及び平面視における位置は一致しているので、回転時における各ハードディスク12の振動やハブ24の回転軸線の傾斜の発生が防がれる。

【0041】また更に、ケーシング10の何れかの辺(図1における長方形状の外形の何れかの辺)を下側として回転軸線の方向を水平方向とした場合、重力による回転スリーブ部26の偏心が生じるが、気流案内板32の案内面32aによってハブ24等に対し空気流による圧力を加える向きは重力の向きに対しほぼ45度に傾斜するので、回転スリーブ部26の回転中心の偏心が過大になってラジアル動圧軸受部の損傷等の不都合を招くことが防がれる。

【0042】以上の実施の形態は、ハードディスク駆動装置を例にとって説明したが、本発明は、ラジアル動圧軸受部を備えたその他の記録装置や、記録装置以外のラジアル動圧軸受部を備えた回転装置についても、同様に適用可能である。

【0043】なお、以上の実施の形態についての記述における上下位置関係は、単に図に基づいた説明の便宜のためのものであって、実際の使用状態等を限定するものではない。

【0044】

【発明の効果】本発明のラジアル動圧軸受部を備えた回転装置では、回転部の回転時に平板状部の回転に伴い移動する流体が流体案内部により案内されることにより、所定の向きの圧力が回転基部に対し継続的に加わるので、回転部の回転中心が一定の向きに偏心し且つその状態が維持される。ラジアル動圧軸受部におけるハーフボウル等の振れ回りを始めとする回転部のNRRD及びRROが効果的に防がれ、回転精度を高めることができる。

【0045】請求項3の回転装置では、回転部の回転中の偏心が過大になってラジアル動圧軸受部の損傷等の不都合を招くことができる。

【0046】本発明の記録装置では、記録媒体の回転時に流体案内部により案内される流体により回転精度を高めて記録媒体に対する読み書き精度を高めることができる。

【0047】請求項5及び6の記録装置では、記録媒体の回転時に流体案内部により案内される流体により回転

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精度を高めると共に、その流体により読み書きヘッドの読み書き作業に悪影響が生ずることが防がれる。

【図面の簡単な説明】

【図1】天板を取り外した状態のハードディスク駆動装置の平面図である。

【図2】図1におけるII-II線拡大断面図である。

【図3】ラジアル動圧軸受部の拡大横断面図である。

【符号の説明】

10 ケーシング

10a 底板

10b 円弧状内周壁部

12 ハードディスク

14 スピンドルモータ

16 磁気ヘッド

18 アクセスアーム

20 天板

22 固定軸体

24a 鋼状部

24 ハブ

26 回転スリーブ部

27 潤滑油

28 ラジアル動圧軸受部

29 スラスト動圧軸受部

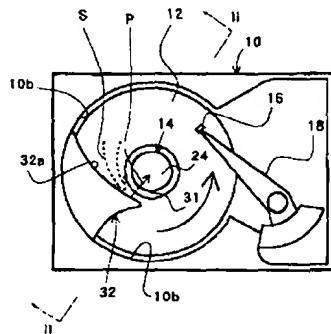
30 スペーサ

31 クランバ

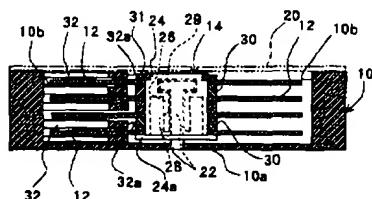
32 気流案内板

32a 案内面

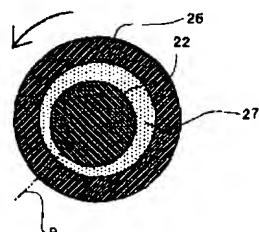
【図1】



【図2】



【図3】



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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the plan of the hard disk drive in the state where the top plate was removed.

[Drawing 2] It is an II-II line expanded sectional view in drawing 1.

[Drawing 3] It is the expansion cross-sectional view of radial dynamic pressure bearing.

[Description of Notations]

10 Casing

10a Bottom plate

10b Circular inner circle wall section

12 Hard Disk

14 Spindle Motor

16 Magnetic Head

18 Access Arm

20 Top Plate

22 Fixed Axis

24a Collar-like part

24 Hub

26 Rotation Sleeve Section

27 Lubricating Oil

28 Radial Dynamic Pressure Bearing

29 Thrust Dynamic Pressure Bearing

30 Spacer

31 Clamper

32 Air Current Guide Plate

32a Slideway

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[Translation done.]

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**DETAILED DESCRIPTION**

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the slewing gear and recording device equipped with radial dynamic pressure bearing which can raise rotational accuracy by swaying using the fluid which moves with rotation of a record disk etc., and preventing the surroundings etc.

[0002]

[Description of the Prior Art] In recent years, the program and the amount of data for personal computers increase, and the request about the rotational accuracy of a hard disk drive's etc. record disk rotation type recording device is becoming still severer. When the bearing which carries out axial support by non-contact [, such as a radial hydrodynamic bearing, ] was used for the spindle motor in such a recording device, it had become the cause which NRRO (asynchronous deflection) and RRO (synchronous deflection) by half HOWARU (half speed whirl) etc. occur in the radial hydrodynamic bearing, and checks the improvement in rotational accuracy.

[0003] the sleeve which constitutes a radial hydrodynamic bearing in order to prevent the circumference of the deflection in a radial hydrodynamic bearing -- although a means to adopt the suitable variant cross section which is not a perfect circle as a cross-section configuration of a member or shank material is proposed, difficulty is followed on processing of the member of such a cross section Moreover, the technology which is made to carry out minute size eccentricity of the center of rotation in the radial hydrodynamic bearing, and prevents the circumference of an axial runout is indicated by JP,11-55918,A by forming local magnetic imbalance in the stator of the spindle motor equipped with the radial hydrodynamic bearing. however, local magnetic imbalance [ in / a stator / such processing about a stator is not easy and / in \*\* ] -- the time of rotation -- electromagnetism -- there is a possibility of promoting vibration

[0004] Furthermore, the request which prevents NRRO and RRO by the circumference of a deflection etc., and raises rotational accuracy also about the slewing gear equipped with radial hydrodynamic bearings other than a record disk rotation type recording device exists similarly.

[0005] the place which this invention is performed in view of the above technical problems which consisted in the conventional technology, and makes into the purpose carry out the eccentricity of the center of rotation of the rotation section to the fixed sense -- NRRO and RRO -- effective -- protect -- rotational accuracy -- it can raise -- the difficulty of manufacture of \*\* , and electromagnetism -- it be in offer a slewing gear and a recording device equipped with radial dynamic pressure bearing which do cause promotion of vibration

[0006]

[Means for Solving the Problem] The slewing gear of this invention is supported free [ rotation around a fixed axis ] for the rotation section to a fixed part through radial dynamic pressure bearing at least. (1) The rotation section It is the slewing gear which is what is equipped with 1 or the two or more plate-like sections which were jutted out over the method of the outside of the direction of a path a rotation base and in the shape of the same axle in the space where a fluid exists from the rotation base which has the

predetermined peripheral face section, and the aforementioned predetermined peripheral face section in the rotation base. The interior of a fluid proposal supported by the aforementioned fixed part fixed is prepared where the field of the direction one side of an axis in all or a part of each of the aforementioned plate-like section or the field of both sides is approached. the aforementioned interior of a fluid proposal The fluid which moves with rotation of the plate-like section in the aforementioned space The method of the inside of the direction of a path inside the fluid proposal, By the flow of the fluid which showed around so that it might gather in the predetermined position of a hoop direction among the space near the periphery of the aforementioned predetermined peripheral face section in a rotation base, and was guided such It is characterized by applying a pressure to the predetermined sense in near

[ aforementioned ] a predetermined position to a rotation base, and for the center of rotation of the rotation section carrying out eccentricity to the fixed sense with the pressure of the aforementioned predetermined sense at the time of rotation of the rotation section, and maintaining the state (claim 1).

[0007] The plate-like section rotates in the shape of the same axle with a rotation base by rotation of the rotation section. Since the plate-like section is jutted out at the method of the outside of the direction of a path in the space where a fluid exists from the predetermined peripheral face section in a rotation base, the fluid which faces which [ of the direction of an axis of the plate-like section ] near field moves with rotation of the plate-like section. Thus, the fluid which moves is guided so that it may gather in the predetermined position in a hoop direction among the space near the periphery of the predetermined peripheral face section (predetermined peripheral face section of the method of the inside of the direction of a path inside the fluid proposal) of a rotation base by the interior of a fluid proposal prepared where which [ of the direction of an axis of the plate-like section ] near field is approached. By the flow of the fluid guided such, a pressure is applied to the predetermined sense in near [ aforementioned ] a predetermined position to a rotation base.

[0008] Thus, at the time of rotation of the rotation section, since the pressure of the aforementioned predetermined sense is continuously added to a rotation base, the state where the bearing clearance of the fixed position (position corresponding to the aforementioned predetermined sense) of the hoop direction in radial dynamic pressure bearing is smaller than the bearing clearance of other portions is maintained by it. That is, the center of rotation of the rotation section carries out eccentricity to the fixed sense, and the state is maintained. Since this will be in the state where the lateral pressure was given to radial dynamic pressure bearing and bearing rigidity increases, NRRO (asynchronous deflection) of the rotation sections including the circumference of deflections, such as half HOWARU (half speed whirl), and RRO (synchronous deflection) are prevented effectively, and can raise rotational accuracy.

[0009] Even if radial dynamic pressure bearing for supporting the rotation section free [ rotation ] to a fixed part is an axial cover half, it may be an axial rotation type. Anyway, in radial dynamic pressure bearing, the rotation section is usually supported in the direction of a path to a fixed part through lubricous fluids, such as lubricants, such as a lubricating oil with which the bearing clearance of a shank and the sleeve section was filled up, or a lubricous gas. Such rotation support of the rotation section shall be performed combining thrust dynamic pressure bearing etc. suitably. In addition, this slewing gear shall constitute a motor by a part of fixed part (or the part) and rotation section (usually rotation base). In this case, Rota is established in a fixed part at a stator and the rotation section.

[0010] A fixed part shall have one [ the both sides of the direction of an axial center, or ] near all or near (the both sides of the direction of an axial center to all the plate-like sections or one side when it has the two or more plate-like sections) inside section which faces in part to the plate-like section. Moreover, a fixed part shall have all or the inner circle wall section surrounded partially for the periphery side of the plate-like section. These inside sections and the inner circle wall section shall contain the portion in which the interior of a fluid proposal is located at least.

[0011] Let the plate-like section be the in-a-circle board (for example, disk form record media, such as various magnetic disks, such as a hard disk, and various optical disks) which was attached for example, outside the rotation base and was held fixed. When two or more sheet outside attachment maintenance of such an in-a-circle board is carried out, it shall hold in the shape of the same axle every direction interval of an axis through an annular spacer in the inner circumference section between in-a-circle

boards. The normal of the field of the direction both sides of an axis of the plate-like section usually serves as the direction of an axis of the plate-like section and a rotation base. In addition, although a plate-like object can also be made removable to a rotation base, fixed maintenance is more desirable when preventing un-arranging, such as oscillating generating under rotation.

[0012] Let a rotation base be the hub of a cup form. Generally the predetermined peripheral face section in a rotation base is a cylinder side configuration. When arranging an annular spacer on the inner circumference section between the in-a-circle boards of two or more sheets as mentioned above, the annular spacer shall constitute a part of rotation base, and shall constitute the predetermined peripheral face section of the above [ the peripheral face section ].

[0013] In the usual case, the fluids which exist in the space which the plate-like section jutted out of the predetermined peripheral face section are a gas, especially air. Although any of a closed space or an open space are sufficient as the aforementioned space, when the rotation section is a quiescent state, as for the fluid in the space, it is desirable that it will be in a substance top quiescent state in the usual case.

[0014] The interior of a fluid proposal is prepared where direction of axis one [ in all or a part of each of the plate-like section ] near field or both each near field (field whose normal is the direction of an axis in the usual case) is approached. That is, when the number of the plate-like sections jutted out from the rotation base is one and one side of the plate-like section, both fields, or the two or more plate-like sections are held, after [ in each of a part or all the plate-like sections ] while has approached a field or both fields, it can prepare.

[0015] When preventing lacking the balance of the fluid style in the field of both one plate-like section, and un-arranging, such as vibration, arising It is desirable that the interior of a fluid proposal facing the field of the both sides of the direction of an axis of the plate-like section, respectively is prepared. the interior of a fluid proposal The thing (for example, make the interior of a fluid proposal the same on substance at both-sides side) on which the flow of the fluid guided in the field of the both sides of the direction of an axis of the plate-like section spreads the real up ones etc. and it is made to become is desirable. Moreover, when preparing the two or more interior of a fluid proposal, it is desirable to prepare so that the eccentricity of the center of rotation at the time of rotation of the rotation section may not become imbalanced in the direction of an axis. For that purpose, for example in the direction of an axis, the interior of a fluid proposal can be prepared symmetrically, or the interior of a fluid proposal can also be prepared so that the pressure which joins the fixed position in the direction of an axis of a rotation base may become larger than others.

[0016] As for the interior of a fluid proposal, it is desirable that it is the position (the state which contacted the position close to the field or its field when the field of one of these was a field of a fixed part, or united state) which approached the both sides among the fields which face in the direction of an axis. When both sides which face in such a direction of an axis are which [ of the direction of an axis of the plate-like section which adjoins in the direction of an axis ] near fields (the interior of a fluid proposal in this case) what is supported by the fixed part in the method of the outside of the direction of a path -- it can carry out -- One side may be which [ of the direction of an axis of the plate-like section ] near field, and another side may be the field of the fixed part which faces in the field and direction of an axis.

[0017] The interior of a fluid proposal has the slideway which approaches a predetermined position, going to the method of the inside of the direction of a path as it progresses ahead in the hand of cut of the rotation section from the fixed position of the method of the outside of the direction of a path rather than the predetermined peripheral face section of for example, a rotation base. by the slideway The fluid which moves with rotation of the plate-like section shall be guided so that it may gather in the predetermined position of a hoop direction among the space near the periphery of the aforementioned predetermined peripheral face section in the rotation base of the method of the inside of the direction of a path of the slideway (claim 2).

[0018] Although it is common to consider as a field parallel to axis of rotation as for the aforementioned slideway, it can also be made to incline to axis of rotation.

[0019] Moreover, a slideway can be made into the curve side which makes the arc of a convex ahead in

the hand of cut of for example, the rotation section, and also also let it be a flat surface.

[0020] In addition, as for a slideway, it is more desirable than near the periphery edge of the plate-like section, or it to approach a predetermined position from the fixed position of the method of the outside of the direction of a path, going to the method of the inside of the direction of a path as it progresses ahead in the hand of cut of the rotation section.

[0021] (2) The slewing gear equipped with the above-mentioned radial dynamic pressure bearing Even if the pressure by the flow of the fluid guided by the interior of a fluid proposal is not added to a rotation base, when the center of rotation of the rotation section carries out eccentricity to the fixed sense in the posture which can usually be taken It is desirable for the sense and the sense of the pressure added to a rotation base by the flow of the fluid guided by the interior of a fluid proposal not to be in agreement (claim 3).

[0022] For example, in the posture which can usually be taken, when axis of rotation is not in agreement in the gravity direction like [ when axis of rotation is almost level ], even if the pressure by the flow of the fluid guided by the interior of a fluid proposal is not added to a rotation base, eccentricity of the center of rotation of the rotation section can be carried out to the fixed sense with gravity. In such a case, when the sense of the eccentricity and the sense of the pressure added to a rotation base by the flow of the fluid guided by the interior of a fluid proposal are in agreement, the eccentricity of the center of rotation of the rotation section becomes excessive, and there is a possibility of causing un-arranging, such as damage on radial dynamic pressure bearing. Although the sense of the pressure added to a rotation base by the flow of the fluid which there is no eccentricity by gravity etc. or was guided with a certain posture by the sense and the interior of a fluid proposal of eccentricity by gravity etc. is not in agreement especially when two or more postures which can usually be taken like every length and a slewing gear with every possible width exist, in another posture, both may be in agreement.

[0023] In such a case, when making it not in agreement [ both sense ] in the posture which a slewing gear can usually take, it can prevent causing un-arranging, such as damage on radial dynamic pressure bearing. both sense -- for example, 45 or 135 degrees -- a central angle -- a thing different a grade -- it can carry out -- 90 degrees -- a central angle -- differing a grade is desirable

[0024] (3) The recording device of this invention shall be equipped with the slewing gear equipped with the above-mentioned radial dynamic pressure bearing, and the plate-like section in the slewing gear shall be a record medium (claim 4).

[0025] In this case, with the fluid guided by the interior of a fluid proposal at the time of rotation of a record medium, NRRO of the rotation sections including the circumference of the deflection in radial dynamic pressure bearing and RRO can be prevented effectively, rotational accuracy can be raised, and the R/W precision over a \*\*\*\*\* record medium can be raised.

[0026] In addition, as for this slewing gear, it is desirable to constitute a motor by a part of fixed part (or the part) and rotation section (usually rotation base).

[0027] It is desirable that it is the position which this recording device has the read-write head to a record medium, and does not have substantial influence on R/W work with the fluid to which it is shown to the position (it can consider as the fixed position of a hoop direction) of the read-write head by the interior of a fluid proposal at the time of rotation of a record medium (claim 5).

[0028] In this case, while the fluid guided by the interior of a fluid proposal at the time of rotation of a record medium raises rotational accuracy, it prevents a bad influence arising in the R/W work of the read-write head with the fluid. In the read-write head equipped with the floating head slider which surfaces on record intermedia dignify especially, it is useful. In addition, the read-write head may be only only for reading or for writing.

[0029] For that purpose, the predetermined position of a hoop direction and the position of the read-write head to which it is shown to a fluid by the interior of a fluid proposal, for example shall be a reverse side on both sides of the rotation section (claim 6).

[0030]

[Embodiments of the Invention] The gestalt of operation of this invention is explained referring to a drawing.

[0031] An II-II line expanded sectional view [ in / drawing 1 / in the plan of the hard disk drive in the state where drawing 1 removed the top plate about the hard disk drive as an example of the gestalt of operation of the recording device (namely, slewing gear equipped with radial dynamic pressure bearing) of this invention in drawing 1 or drawing 3 , and drawing 2 ], and drawing 3 are the expansion cross-sectional views of radial dynamic pressure bearing in the spindle motor which drives a hard disk.

[0032] The spindle motor 14 (motor) which carried out fixed maintenance of the hard disk 12, and the access arm 18 which supported the magnetic head 16 equipped with the floating head slider (not shown) for R/W to the point are mainly formed in the box-like casing 10 of upper part opening whose appearance is a rectangular parallelepiped configuration, and a top plate 20 comes to seal this hard disk drive. Air exists in casing 10.

[0033] The radial dynamic pressure bearing 28 and its upper thrust dynamic pressure bearing 29 which are constituted by attaching outside the rotation sleeve section 26 by which the soffit was prepared in the interior of the hub 24 of a cup form to the fixed axis 22 fixed to bottom plate 10a of casing 10 through a lubricating oil 27 come to support a spindle motor 14 in the state where the rotation sleeve section 26 is non-contact to the fixed axis 22 free [ rotation ].

[0034] The hard disk 12 of four sheets (three or less sheets or five sheets or more are sufficient) is attached outside the hub 24 of a spindle motor 14 the shape of a hub 24 and the same axle, and fixed maintenance is carried out. Fixed maintenance of each hard disk 12 is carried out every direction interval of an axis by supporting the hard disk 12 of a soffit on collar-like part 24a of the soffit of a hub 24, carrying out the laminating of an annular spacer 30 and an annular hard disk 12 by turns, and fixing the annular clamper 31 on the topmost hard disk 12 on it. Moreover, the periphery side of all the hard disks 12 is surrounded except for the side in which an access arm 18 exists by circular inner circle wall section 10b of the shape of a spindle motor 14 and the said heart in casing 10.

[0035] In the above, casing 10 and the fixed axis 22 mainly constitute a fixed part, and the rotation sleeve section 26, a hub 24, a spacer 30, a clamper 31, and a hard disk 12 mainly constitute the rotation section, among those the rotation sleeve section 26, a hub 24, a spacer 30, and a clamper 31 constitute a rotation base.

[0036] The air current guide plate 32 (interior of a fluid proposal) is mostly formed from the hoop-direction position by the side of reverse over the fixed range by the side of the back in the hand of cut (the sense of the arrow in drawing 1 , i.e., left-handed rotation) of a hard disk 12 across the hub 24 to the magnetic head 16 supported by the access arm 18. The air current guide plate 32 is in the state close to the vertical side of each hard disk 12, and the method section of the outside of the direction of a path is supported by circular inner circle wall section 10b of casing 10. The air current guide plate 32 by the side of the undersurface of the hard disk 12 of a soffit The upper surface approaches the undersurface of the hard disk 12 of a soffit, and the undersurface approaches the base in casing 10. the air current guide plate 32 between hard disk 12 comrades A vertical side approaches the undersurface of the upper hard disk 12, and the upper surface of the lower hard disk 12, respectively, the undersurface approaches the upper surface of the hard disk 12 of a upper limit, and, as for the air current guide plate 32 by the side of the upper surface of the hard disk 12 of a upper limit, the upper surface approaches the undersurface of a top plate 20. The position in the flat-surface configuration and plane view of all the air current guide plates 32 is in agreement (but it does not necessarily require that it is in agreement.).

[0037] The field by the side of the back of the air current guide plate 32 in the hand of cut of a hard disk 12 constitutes slideway 32a (it is a perpendicular field to a field parallel to axis of rotation, i.e., the field which intersects perpendicularly with axis of rotation) which curved so that the arc of a convex might be made ahead in a hand of cut. It approaches the predetermined position (it faces across a hub 24 to the magnetic head 16, and is a position by the side of reverse mostly) of a hoop direction among the space near the periphery of collar-like part 24a of a hub 24, a spacer 30, and each peripheral face section (predetermined peripheral face section of a rotation base) of a clamper 31, this slideway 32a going to the method of the inside of the direction of a path from circular inner circle wall section 10b of casing 10, as it progresses ahead in a hand of cut.

[0038] If a hard disk 12 rotates by rotation of a spindle motor 14, the air which faces the vertical side of

each hard disk 12, respectively will move with rotation of a hard disk 12. Thus, the air which moves is guided by slideway 32a of each air current guide plate 32 formed where the vertical side of each hard disk 12 is approached like \*\*\*\* S in drawing 1, and gathers in a predetermined position by it among the space near the periphery of collar-like part 24a, a spacer 30, and each peripheral face section of a clamper 31. Thus, by the flow of the air guided, a pressure joins the sense of \*\*\*\* P in drawing 1 and drawing 3 in near [ aforementioned ] a predetermined position to a hub 24 and the rotation sleeve section 26 through collar-like part 24a, a spacer 30, and a clamper 31. Since the pressure of the sense of \*\*\*\* P is continuously added to a hub 24 and the rotation sleeve section 26 during rotation of a spindle motor 14, the state where the bearing clearance of the fixed position of the hoop direction in radial dynamic pressure bearing is smaller than the bearing clearance of other portions as shown in drawing 3 is maintained by it. That is, the center of rotation of the rotation sleeve section 26 carries out eccentricity to the fixed sense, and the state is maintained. By this, NRRO by half HOWARU in radial dynamic pressure bearing etc. and RRO can be prevented effectively, and rotational accuracy can be raised, with the precision of the R/W by the read-write head to each hard disk 12 can be raised.

[0039] Moreover, since the position which applies the pressure by the airstream to a hub 24 etc. by slideway 32a of the air current guide plate 32, and the position of the read-write head are reverse sides across a hub 24, it prevents a bad influence arising in the R/W work of the read-write head by the airstream.

[0040] Furthermore, since the air current guide plate 32 is formed where the vertical side of all the hard disks 12 is approached, and the position in the flat-surface configuration and plane view of all the air current guide plates 32 is in agreement, the vibration of each hard disk 12 and generating of the inclination of axis of rotation of a hub 24 at the time of rotation are prevented.

[0041] Furthermore, although the eccentricity of the rotation sleeve section 26 by gravity arises when the direction of axis of rotation is made horizontal by making which the side (which side of the appearance of the shape of a rectangle in drawing 1) of casing 10 into the bottom Since the sense which applies the pressure by the airstream to a hub 24 etc. inclines at about 45 degrees to the sense of gravity by slideway 32a of the air current guide plate 32, it prevents the eccentricity of the center of rotation of the rotation sleeve section 26 becoming excessive, and causing un-arranging, such as damage on radial dynamic pressure bearing.

[0042] Although the gestalt of the above operation was explained taking the case of hard disk drive, this invention is applicable similarly about the recording device of others equipped with radial dynamic pressure bearing, and the slewing gear equipped with radial dynamic pressure bearings other than a recording device.

[0043] In addition, the vertical physical relationship in the description about the form of the above operation is only a thing for the facilities of the explanation based on drawing, and does not limit an actual busy condition etc.

[0044]

[Effect of the Invention] In the slewing gear equipped with radial dynamic pressure bearing of this invention Since the pressure of the predetermined sense is continuously added to a rotation base when the fluid which moves with rotation of the plate-like section at the time of rotation of the rotation section is guided by the interior of a fluid proposal NRRO of the rotation sections including the circumference of deflections, such as half HOWARU in radial dynamic pressure bearing in which the center of rotation of the rotation section carries out eccentricity to the fixed sense and by which the state is maintained, and RRO are prevented effectively, and can raise rotational accuracy.

[0045] In the slewing gear of a claim 3, it can prevent the eccentricity of the center of rotation of the rotation section becoming excessive, and causing un-arranging, such as damage on radial dynamic pressure bearing.

[0046] In the recording device of this invention, the fluid guided by the interior of a fluid proposal at the time of rotation of a record medium can raise rotational accuracy, and the R/W precision over a record medium can be raised.

[0047] In the recording device of claims 5 and 6, while the fluid guided by the interior of a fluid

proposal at the time of rotation of a record medium raises rotational accuracy, it prevents a bad influence arising in the R/W work of the read-write head with the fluid.

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[Translation done.]

## \* NOTICES \*

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

## MEANS

[Means for Solving the Problem] The slewing gear of this invention is supported free [ rotation around a fixed axis ] for the rotation section to a fixed part through radial dynamic pressure bearing at least. (1) The rotation section It is the slewing gear which is what is equipped with 1 or the two or more plate-like sections which were jutted out over the method of the outside of the direction of a path a rotation base and in the shape of the same axle in the space where a fluid exists from the rotation base which has the predetermined peripheral face section, and the aforementioned predetermined peripheral face section in the rotation base. The interior of a fluid proposal supported by the aforementioned fixed part fixed is prepared where the field of the direction one side of an axis in all or a part of each of the aforementioned plate-like section or the field of both sides is approached. the aforementioned interior of a fluid proposal The fluid which moves with rotation of the plate-like section in the aforementioned space The method of the inside of the direction of a path inside the fluid proposal, By the flow of the fluid which showed around so that it might gather in the predetermined position of a hoop direction among the space near the periphery of the aforementioned predetermined peripheral face section in a rotation base, and was guided such It is characterized by applying a pressure to the predetermined sense in near [ aforementioned ] a predetermined position to a rotation base, and for the center of rotation of the rotation section carrying out eccentricity to the fixed sense with the pressure of the aforementioned predetermined sense at the time of rotation of the rotation section, and maintaining the state (claim 1). [0007] The plate-like section rotates in the shape of the same axle with a rotation base by rotation of the rotation section. Since the plate-like section is jutted out at the method of the outside of the direction of a path in the space where a fluid exists from the predetermined peripheral face section in a rotation base, the fluid which faces which [ of the direction of an axis of the plate-like section ] near field moves with rotation of the plate-like section. Thus, the fluid which moves is guided so that it may gather in the predetermined position in a hoop direction among the space near the periphery of the predetermined peripheral face section (predetermined peripheral face section of the method of the inside of the direction of a path inside the fluid proposal) of a rotation base by the interior of a fluid proposal prepared where which [ of the direction of an axis of the plate-like section ] near field is approached. By the flow of the fluid guided such, a pressure is applied to the predetermined sense in near [ aforementioned ] a predetermined position to a rotation base.

[0008] Thus, at the time of rotation of the rotation section, since the pressure of the aforementioned predetermined sense is continuously added to a rotation base, the state where the bearing clearance of the fixed position (position corresponding to the aforementioned predetermined sense) of the hoop direction in radial dynamic pressure bearing is smaller than the bearing clearance of other portions is maintained by it. That is, the center of rotation of the rotation section carries out eccentricity to the fixed sense, and the state is maintained. Since this will be in the state where the lateral pressure was given to radial dynamic pressure bearing and bearing rigidity increases, NRRO (asynchronous deflection) of the rotation sections including the circumference of deflections, such as half HOWARU (half speed whirl), and RRO (synchronous deflection) are prevented effectively, and can raise rotational accuracy.

[0009] Even if radial dynamic pressure bearing for supporting the rotation section free [ rotation ] to a

fixed part is an axial cover half, it may be an axial rotation type. Anyway, in radial dynamic pressure bearing, the rotation section is usually supported in the direction of a path to a fixed part through lubricous fluids, such as lubricants, such as a lubricating oil with which the bearing clearance of a shank and the sleeve section was filled up, or a lubricous gas. Such rotation support of the rotation section shall be performed combining thrust dynamic pressure bearing etc. suitably. In addition, this slewing gear shall constitute a motor by a part of fixed part (or the part) and rotation section (usually rotation base). In this case, Rota is established in a fixed part at a stator and the rotation section.

[0010] A fixed part shall have one [ the both sides of the direction of an axial center, or ] near all or near (the both sides of the direction of an axial center to all the plate-like sections or one side when it has the two or more plate-like sections) inside section which faces in part to the plate-like section. Moreover, a fixed part shall have all or the inner circle wall section surrounded partially for the periphery side of the plate-like section. These inside sections and the inner circle wall section shall contain the portion in which the interior of a fluid proposal is located at least.

[0011] Let the plate-like section be the in-a-circle board (for example, disk form record media, such as various magnetic disks, such as a hard disk, and various optical disks) which was attached for example, outside the rotation base and was held fixed. When two or more sheet outside attachment maintenance of such an in-a-circle board is carried out, it shall hold in the shape of the same axle every direction interval of an axis through an annular spacer in the inner circumference section between in-a-circle boards. The normal of the field of the direction both sides of an axis of the plate-like section usually serves as the direction of an axis of the plate-like section and a rotation base. In addition, although a plate-like object can also be made removable to a rotation base, fixed maintenance is more desirable when preventing un-arranging, such as oscillating generating under rotation.

[0012] Let a rotation base be the hub of a cup form. Generally the predetermined peripheral face section in a rotation base is a cylinder side configuration. When arranging an annular spacer on the inner circumference section between the in-a-circle boards of two or more sheets as mentioned above, the annular spacer shall constitute a part of rotation base, and shall constitute the predetermined peripheral face section of the above [ the peripheral face section ].

[0013] In the usual case, the fluids which exist in the space which the plate-like section jutted out of the predetermined peripheral face section are a gas, especially air. Although any of a closed space or an open space are sufficient as the aforementioned space, when the rotation section is a quiescent state, as for the fluid in the space, it is desirable that it will be in a substance top quiescent state in the usual case.

[0014] The interior of a fluid proposal is prepared where direction of axis one [ in all or a part of each of the plate-like section ] near field or both each near field (field whose normal is the direction of an axis in the usual case) is approached. That is, when the number of the plate-like sections jutted out from the rotation base is one and one side of the plate-like section, both fields, or the two or more plate-like sections are held, after [ in each of a part or all the plate-like sections ] while has approached a field or both fields, it can prepare.

[0015] When preventing lacking the balance of the fluid style in the field of both one plate-like section, and un-arranging, such as vibration, arising It is desirable that the interior of a fluid proposal facing the field of the both sides of the direction of an axis of the plate-like section, respectively is prepared. the interior of a fluid proposal The thing (for example, make the interior of a fluid proposal the same on substance at both-sides side) on which the flow of the fluid guided in the field of the both sides of the direction of an axis of the plate-like section spreads the real up one etc. and it is made to become is desirable. Moreover, when preparing the two or more interior of a fluid proposal, it is desirable to prepare so that the eccentricity of the center of rotation at the time of rotation of the rotation section may not become imbalanced in the direction of an axis. For that purpose, for example in the direction of an axis, the interior of a fluid proposal can be prepared symmetrically, or the interior of a fluid proposal can also be prepared so that the pressure which joins the fixed position in the direction of an axis of a rotation base may become larger than others.

[0016] As for the interior of a fluid proposal, it is desirable that it is the position (the state which contacted the position close to the field or its field when the field of one of these was a field of a fixed

part, or united state) which approached the both sides among the fields which face in the direction of an axis. When both sides which face in such a direction of an axis are which [ of the direction of an axis of the plate-like section which adjoins in the direction of an axis ] near fields (the interior of a fluid proposal in this case) what is supported by the fixed part in the method of the outside of the direction of a path -- it can carry out -- One side may be which [ of the direction of an axis of the plate-like section ] near field, and another side may be the field of the fixed part which faces in the field and direction of an axis.

[0017] The interior of a fluid proposal has the slideway which approaches a predetermined position, going to the method of the inside of the direction of a path as it progresses ahead in the hand of cut of the rotation section from the fixed position of the method of the outside of the direction of a path rather than the predetermined peripheral face section of for example, a rotation base. by the slideway The fluid which moves with rotation of the plate-like section shall be guided so that it may gather in the predetermined position of a hoop direction among the space near the periphery of the aforementioned predetermined peripheral face section in the rotation base of the method of the inside of the direction of a path of the slideway (claim 2).

[0018] Although it is common to consider as a field parallel to axis of rotation as for the aforementioned slideway, it can also be made to incline to axis of rotation.

[0019] Moreover, a slideway can be made into the curve side which makes the arc of a convex ahead in the hand of cut of for example, the rotation section, and also also let it be a flat surface.

[0020] In addition, as for a slideway, it is more desirable than near the periphery edge of the plate-like section, or it to approach a predetermined position from the fixed position of the method of the outside of the direction of a path, going to the method of the inside of the direction of a path as it progresses ahead in the hand of cut of the rotation section.

[0021] (2) The slewing gear equipped with the above-mentioned radial dynamic pressure bearing Even if the pressure by the flow of the fluid guided by the interior of a fluid proposal is not added to a rotation base, when the center of rotation of the rotation section carries out eccentricity to the fixed sense in the posture which can usually be taken It is desirable for the sense and the sense of the pressure added to a rotation base by the flow of the fluid guided by the interior of a fluid proposal not to be in agreement (claim 3).

[0022] For example, in the posture which can usually be taken, when axis of rotation is not in agreement in the gravity direction like [ when axis of rotation is almost level ], even if the pressure by the flow of the fluid guided by the interior of a fluid proposal is not added to a rotation base, eccentricity of the center of rotation of the rotation section can be carried out to the fixed sense with gravity. In such a case, when the sense of the eccentricity and the sense of the pressure added to a rotation base by the flow of the fluid guided by the interior of a fluid proposal are in agreement, the eccentricity of the center of rotation of the rotation section becomes excessive, and there is a possibility of causing un-arranging, such as damage on radial dynamic pressure bearing. Although the sense of the pressure added to a rotation base by the flow of the fluid which there is no eccentricity by gravity etc. or was guided with a certain posture by the sense and the interior of a fluid proposal of eccentricity by gravity etc. is not in agreement especially when two or more postures which can usually be taken like every length and a slewing gear with every possible width exist, in another posture, both may be in agreement.

[0023] In such a case, when making it not in agreement [ both sense ] in the posture which a slewing gear can usually take, it can prevent causing un-arranging, such as damage on radial dynamic pressure bearing. both sense -- for example, 45 or 135 degrees -- a central angle -- a thing different a grade -- it can carry out -- 90 degrees -- a central angle -- differing a grade is desirable

[0024] (3) The recording device of this invention shall be equipped with the slewing gear equipped with the above-mentioned radial dynamic pressure bearing, and the plate-like section in the slewing gear shall be a record medium (claim 4).

[0025] In this case, with the fluid guided by the interior of a fluid proposal at the time of rotation of a record medium, NRRO of the rotation sections including the circumference of the deflection in radial dynamic pressure bearing and RRO can be prevented effectively, rotational accuracy can be raised, and

the R/W precision over a \*\*\*\*\* record medium can be raised.

[0026] In addition, as for this slewing gear, it is desirable to constitute a motor by a part of fixed part (or the part) and rotation section (usually rotation base).

[0027] It is desirable that it is the position which this recording device has the read-write head to a record medium, and does not have substantial influence on R/W work with the fluid to which it is shown to the position (it can consider as the fixed position of a hoop direction) of the read-write head by the interior of a fluid proposal at the time of rotation of a record medium (claim 5).

[0028] In this case, while the fluid guided by the interior of a fluid proposal at the time of rotation of a record medium raises rotational accuracy, it prevents a bad influence arising in the R/W work of the read-write head with the fluid. In the read-write head equipped with the floating head slider which surfaces on record intermediation dignity especially, it is useful. In addition, the read-write head may be only for reading or for writing.

[0029] For that purpose, the predetermined position of a hoop direction and the position of the read-write head to which it is shown to a fluid by the interior of a fluid proposal, for example shall be a reverse side on both sides of the rotation section (claim 6).

[0030]

[Embodiments of the Invention] The form of operation of this invention is explained referring to a drawing.

[0031] An II-II line expanded sectional view [ in / drawing 1 / in the plan of the hard disk drive in the state where drawing 1 removed the top plate about the hard disk drive as an example of the form of operation of the recording device (namely, slewing gear equipped with radial dynamic pressure bearing) of this invention in drawing 1 or drawing 3, and drawing 2 ], and drawing 3 are the expansion cross-sectional views of radial dynamic pressure bearing in the spindle motor which drives a hard disk.

[0032] The spindle motor 14 (motor) which carried out fixed maintenance of the hard disk 12, and the access arm 18 which supported the magnetic head 16 equipped with the floating head slider (not shown) for R/W to the point are mainly formed in the box-like casing 10 of upper part opening whose appearance is a rectangular parallelepiped configuration, and a top plate 20 comes to seal this hard disk drive. Air exists in casing 10.

[0033] The radial dynamic pressure bearing 28 and its upper thrust dynamic pressure bearing 29 which are constituted by attaching outside the rotation sleeve section 26 by which the soffit was prepared in the interior of the hub 24 of a cup form to the fixed axis 22 fixed to bottom plate 10a of casing 10 through a lubricating oil 27 come to support a spindle motor 14 in the state where the rotation sleeve section 26 is non-contact to the fixed axis 22 free [ rotation ].

[0034] The hard disk 12 of four sheets (three or less sheets or five sheets or more are sufficient) is attached outside the hub 24 of a spindle motor 14 the shape of a hub 24 and the same axle, and fixed maintenance is carried out. Fixed maintenance of each hard disk 12 is carried out every direction interval of an axis by supporting the hard disk 12 of a soffit on collar-like part 24a of the soffit of a hub 24, carrying out the laminating of an annular spacer 30 and an annular hard disk 12 by turns, and fixing the annular clumper 31 on the topmost hard disk 12 on it. Moreover, the periphery side of all the hard disks 12 is surrounded except for the side in which an access arm 18 exists by circular inner circle wall section 10b of the shape of a spindle motor 14 and the said heart in casing 10.

[0035] In the above, casing 10 and the fixed axis 22 mainly constitute a fixed part, and the rotation sleeve section 26, a hub 24, a spacer 30, a clumper 31, and a hard disk 12 mainly constitute the rotation section, among those the rotation sleeve section 26, a hub 24, a spacer 30, and a clumper 31 constitute a rotation base.

[0036] The air current guide plate 32 (interior of a fluid proposal) is mostly formed from the hoop-direction position by the side of reverse over the fixed range by the side of the back in the hand of cut (the sense of the arrow in drawing 1, i.e., left-handed rotation) of a hard disk 12 across the hub 24 to the magnetic head 16 supported by the access arm 18. The air current guide plate 32 is in the state close to the vertical side of each hard disk 12, and the method section of the outside of the direction of a path is supported by circular inner circle wall section 10b of casing 10. The air current guide plate 32 by the

side of the undersurface of the hard disk 12 of a soffit The upper surface approaches the undersurface of the hard disk 12 of a soffit, and the undersurface approaches the base in casing 10. the air current guide plate 32 between hard disk 12 comrades A vertical side approaches the undersurface of the upper hard disk 12, and the upper surface of the lower hard disk 12, respectively, the undersurface approaches the upper surface of the hard disk 12 of a upper limit, and, as for the air current guide plate 32 by the side of the upper surface of the hard disk 12 of a upper limit, the upper surface approaches the undersurface of a top plate 20. The position in the flat-surface configuration and plane view of all the air current guide plates 32 is in agreement (but it does not necessarily require that it is in agreement.).

[0037] The field by the side of the back of the air current guide plate 32 in the hand of cut of a hard disk 12 constitutes slideway 32a (it is a perpendicular field to a field parallel to axis of rotation, i.e., the field which intersects perpendicularly with axis of rotation) which curved so that the arc of a convex might be made ahead in a hand of cut. It approaches the predetermined position (it faces across a hub 24 to the magnetic head 16, and is a position by the side of reverse mostly) of a hoop direction among the space near the periphery of collar-like part 24a of a hub 24, a spacer 30, and each peripheral face section (predetermined peripheral face section of a rotation base) of a clamer 31, this slideway 32a going to the method of the inside of the direction of a path from circular inner circle wall section 10b of casing 10, as it progresses ahead in a hand of cut.

[0038] If a hard disk 12 rotates by rotation of a spindle motor 14, the air which faces the vertical side of each hard disk 12, respectively will move with rotation of a hard disk 12. Thus, the air which moves is guided by slideway 32a of each air current guide plate 32 formed where the vertical side of each hard disk 12 is approached like \*\*\*\* S in drawing 1, and gathers in a predetermined position by it among the space near the periphery of collar-like part 24a, a spacer 30, and each peripheral face section of a clamer 31. Thus, by the flow of the air guided, a pressure joins the sense of \*\*\*\* P in drawing 1 and drawing 3 in near [ aforementioned ] a predetermined position to a hub 24 and the rotation sleeve section 26 through collar-like part 24a, a spacer 30, and a clamer 31. Since the pressure of the sense of \*\*\*\* P is continuously added to a hub 24 and the rotation sleeve section 26 during rotation of a spindle motor 14, the state where the bearing clearance of the fixed position of the hoop direction in radial dynamic pressure bearing is smaller than the bearing clearance of other portions as shown in drawing 3 is maintained by it. That is, the center of rotation of the rotation sleeve section 26 carries out eccentricity to the fixed sense, and the state is maintained. By this, NRRO by half HOWARU in radial dynamic pressure bearing etc. and RRO can be prevented effectively, and rotational accuracy can be raised, with the precision of the R/W by the read-write head to each hard disk 12 can be raised.

[0039] Moreover, since the position which applies the pressure by the airstream to a hub 24 etc. by slideway 32a of the air current guide plate 32, and the position of the read-write head are reverse sides across a hub 24, it prevents a bad influence arising in the R/W work of the read-write head by the airstream.

[0040] Furthermore, since the air current guide plate 32 is formed where the vertical side of all the hard disks 12 is approached, and the position in the flat-surface configuration and plane view of all the air current guide plates 32 is in agreement, the vibration of each hard disk 12 and generating of the inclination of axis of rotation of a hub 24 at the time of rotation are prevented.

[0041] Furthermore, although the eccentricity of the rotation sleeve section 26 by gravity arises when the direction of axis of rotation is made horizontal by making which the side (which side of the appearance of the shape of a rectangle in drawing 1 ) of casing 10 into the bottom Since the sense which applies the pressure by the airstream to a hub 24 etc. inclines at about 45 degrees to the sense of gravity by slideway 32a of the air current guide plate 32, it prevents the eccentricity of the center of rotation of the rotation sleeve section 26 becoming excessive, and causing un-arranging, such as damage on radial dynamic pressure bearing.

[0042] Although the form of the above operation was explained taking the case of hard disk drive, this invention is applicable similarly about the recording device of others equipped with radial dynamic pressure bearing, and the slewing gear equipped with radial dynamic pressure bearings other than a recording device.

[0043] In addition, the vertical physical relationship in the description about the form of the above operation is only a thing for the facilities of the explanation based on drawing, and does not limit an actual busy condition etc.

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[Translation done.]